The Flasher Geometry Cut

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Largest contamination to solar neutrino signals in SNO comes from the so called flasher events. A cut [1] is designed to identify flashers based on their characteristic topologies. Normally a flasher can produce a cluster of hits caused by pick ups on one side of the detector and lots of hits on the opposite side of the detector. Genuine physics events are not expected to produce such hit patterns.

The cut works as the followings:

1. Looping through all hits in an event to search for a cluster of hits with at least $n_{cluster}$ hits within a circle of radius of $r_{cluster}$. $n_{cluster}$ and $r_{cluster}$ are tunable parameters whose default values are 6 and 100cm respectively. These default values are chosen empircally. PMTs connected to a single paddle card roughly occupy similar PSUP space as a circle of 100cm raius.

2. If no cluster is found, the event passes this cut. Otherwise we calculate average distance between this cluster and all of other hits. If more than one cluster is found, we repeat previous calculations for each cluster and the largest distance is used in the cut described in the next step.

3. If the distance calculated in step 2 is larger than d_{cut}, the event is identified as a flasher. d_{cut} is again a tunable parameter whose default value is set as 1202cm.

As figure 1 shows, such cut can remove majority of flasher events while retaining most of the ^{16}N events. Note for majority of the ^{16}N events, the cluster could not be found at all, thus they pass the cut easily.

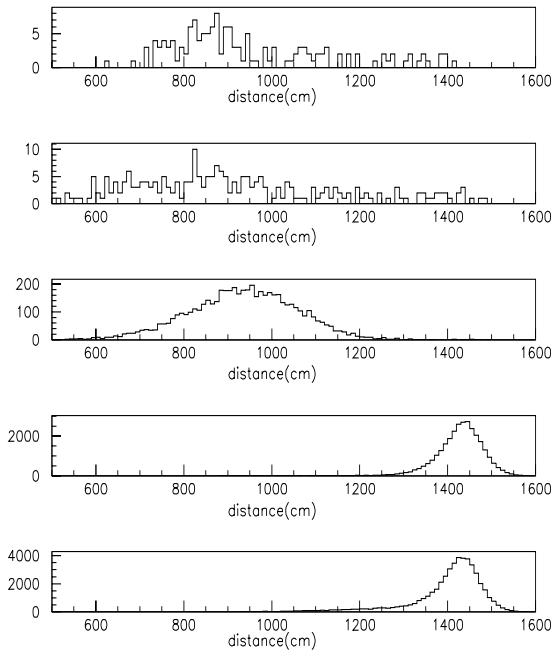

Figure 1: Average distance plots for various classes of events(from top to bottom): ^{16}N events with source located at (0, 0, 0), (0, 400, 0), (-586, 208, -400), flasher events from two different data set selected by hand scanning.

References

[1] X.Chen; April 4, 2000; The Flasher Geometry Cut, SNO-STR-2000-030.